Date: December 30, 2015

EIC Detector R&D Progress Report

Project ID: eRD17
Project Name: DPMJetHybrid 2.0: A Tool to Refine Detector Requirements for eA Collisions in the Nuclear Shadowing / Saturation Regime
Period Reported: from October 1, 2015 to December 31, 2015
Project Leader: Mark D. Baker
Contact Person: Mark D. Baker

Project members
Mark D. Baker – Mark D. Baker Physics and Detector Simulations LLC
Elke-Caroline Aschenauer – Brookhaven National Laboratory
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Abstract

We propose to upgrade the eA DIS event generator DPMJetHybrid to include some key nuclear shadowing / parton saturation effects that are currently missing in the suite of eA event generators available for physics simulations. These event generators, partly supported by previous EIC R&D funding, have been essential in establishing detector requirements for various physics measurements. However, the particle production model in the forward region for eA (along the ion direction) needs improvement in order to clarify those requirements for measurements at either eRHIC or MEIC. We plan to add a flexible model for intrinsic k_T and multi-nucleon k_T-recoil sharing for eA collisions. This model will automatically factor in improved information as we include updated nuclear PDFs from RHIC or the LHC. In order to test and shakedown the model, we plan to use it to study the impact of forward detectors on two important topics in eA: centrality measures and correlations between forward particles and particles from the hard scattering.

Past

What was planned for this period?
Nothing was planned for this period.
This is a new project, and due to the partial funding of the proposal, the project start date was changed to January 4, 2016.

What was achieved?
As suggested by the committee, we are making an effort to garner input from the potential user community for this computer program. Aschenauer discussed the DPMJetHybrid 2.0 project at Thomas Jefferson National Laboratory EIC Software Workshop, September 2015, which led to a healthy discussion. Baker will discuss intrinsic k_T (see next paragraph) in a parallel session and Elke will mention it in her plenary session talk at the EIC User Group Meeting, Berkeley, CA, January 2016. Baker has also been invited to speak, explicitly about DPMJetHybrid 2.0, at the Next Generation Nuclear Physics with JLab12 and EIC Workshop, Miami, FL, February 2016.

As part of a separate project by Baker and Aschenauer, our understanding of forward particles in ep collisions was significantly improved, which is an essential part of better describing forward particles in eA collisions. Using ZEUS data, Pythia-6, an essential component of DPMJetHybrid, was tuned to better describe the longitudinal distribution of forward particle production in ep collisions. Furthermore, it was shown that the ZEUS data, even though they is reported in the laboratory rather than the hadronic center of mass system, are still able to rule out high values of intrinsic k_T using Pythia. This validates, using data, the Monte-Carlo based assertion that we made in the proposal that particles from the beam remnant jet can be used to constrain intrinsic k_T.

What was not achieved, why not, and what will be done to correct?
N/A

Future

What is planned for the next funding cycle and beyond? How, if at all, is this planning different from the original plan?
Due to the funding constraints on FY2016, the current plan is to perform phase 2 of the original proposal in FY2017 rather than FY2016.

What are critical issues?
No concerns have been identified.

Additional information:

Manpower

Include a list of the existing manpower and what approximate fraction each has spent on the project. If students and/or postdocs were funded through the R&D, please state where they were located, what fraction of their time they spend on EIC R&D, and

who supervised their work.

Since the project hasn't officially started, the manpower report is not applicable yet.

External Funding

Describe what external funding was obtained, if any. The report must clarify what has been accomplished with the EIC R&D funds and what came as a contribution from potential collaborators.

Brookhaven National Laboratory physics department funding supported Aschenauer's work on garnering input from the community and on intrinsic k_T in ep. Baker's work on these topics was supported by BNL physics funding through the end of October 2015 and by MDBPADS LLC during November-December 2015.

Publications

Please provide a list of publications coming out of the R&D effort.

N/A – the project is just starting.